

**DEPRESSIVE SYMPTOMS AND QUALITY OF LIFE IN PEOPLE WITH
AGE- RELATED MACULAR DEGENERATION**

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1 **ABSTRACT**

2 **Purpose:** To examine quality of life and associated factors in people with Age-Related Macular
3 Degeneration (AMD).

4 **Methods:** 145 AMD participants (mean age 78.0 ± 7.7 years) and 104 age- and gender- matched
5 controls (mean age 78.1 ± 5.8 years) comprised the study populations for this case-control study.
6 Depressive symptoms were measured with the Goldberg Anxiety and Depression (GAD) scale;
7 general health and daily functioning was assessed with the Medical Outcomes Study Short Form 36
8 and questions relating to assistance required for daily living activities.

9 **Results:** People with AMD performed more poorly than controls on the GAD depression scale, and
10 physical functioning subscale of SF-36. 44.4% of people with AMD had clinically significant
11 depressive symptoms compared to 17.5% of controls ($p < 0.001$). Multiple regression analysis
12 revealed that AMD was independently associated with depressive symptoms and a path model
13 indicated that AMD led to depressive symptoms both directly and indirectly via reduced general
14 health and social functioning.

15 **Conclusion:** Psychological and functional outcome measures are reduced in people with AMD.
16 Earlier recognition and treatment of depressive symptoms in people with AMD may be crucial to
17 maintaining quality of life in this group.

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1 INTRODUCTION

2 Age Related Macular Degeneration (AMD) is the most common cause of visual loss in the elderly
3 and one of the most daunting conditions for older people. In developed countries, it affects 10% of
4 those in the age group 65-74 years and 30% of those 75 years and above¹. AMD has been reported as
5 the leading cause of blindness in people aged over 40 years^{2,3}.

6 Previous studies have examined the quality of life implications of AMD. Some have shown
7 that the presence of AMD is associated with difficulties in performing daily tasks and emotional
8 distress^{4,5,7-9}. Depression, in particular, has many adverse consequences if left untreated including
9 decreased functioning and increased rates of institutionalisation and mortality^{11, 12}. However, one
10 study suggests that people with AMD report good life satisfaction despite difficulties with mobility
11 and daily living activities as the condition challenged them to find new coping strategies⁶. These
12 conflicting findings indicate that further study is required to determine the extent to which AMD can
13 adversely affect emotional health and quality of life.

14 In this study we assessed the presence of depressive symptoms and its relationship to
15 comorbidities, physical activity levels, physical and social functioning and requirements for
16 assistance with daily living related activities in large samples of people with AMD and age- and
17 gender-matched controls. This information is important for understanding the full impact of AMD on
18 psychosocial measures with implications for service provision.

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21 METHODS

22 249 participants were recruited from a retinal clinic, the Macular Degeneration Foundation,
23 Neuroscience Research Australia (previously the Prince of Wales Medical Research Institute) and
24 the School of Optometry and Vision Science Clinic located within Sydney, Australia. The
25 participants were divided into two groups: participants diagnosed with AMD, and participants

1 without reported ocular diseases (controls). At the Sydney Retina and Sydney Eye Clinics, staff
 2 provided potential subjects study information sheets with instructions to contact the primary
 3 researcher if they were interested in taking part in the study. Recruitment at the MD Foundation
 4 involved identifying potential subjects from the database and sending them information sheets and
 5 contact details of the researcher by mail. The data for the control subjects were collected by random
 6 selection matching for age and gender from the database for normal subjects of the Falls and Balance
 7 Research Group at Neuroscience Research Australia, which comprised 500 people aged 65 years and
 8 older. Inclusion criteria for the AMD group were people aged over 55 years, and with clinical
 9 evidence of AMD of at least AREDS Category 313 and visual acuity better than or equal to 6/60 and
 10 no ocular co-morbidities. The control group were those without self-reported ocular diseases
 11 (including cataract, macular degeneration, diabetic retinopathy, glaucoma etc) and age- and gender-
 12 matched to the AMD group. This study was conducted with approval from the Human Research
 13 Ethics Committee, University of New South Wales, and followed the tenets of the Declaration of
 14 Helsinki.

15 The nine Depression items from the Goldberg Anxiety and Depression (GAD) scale were
 16 used to screen for depressive symptoms. One point on this scale is given for every positive response
 17 and a score of 2 or greater indicates clinically significant symptomatology¹⁴. The GAD has excellent
 18 validity within an aged population^{14, 15} with a sensitivity of 86% and overall specificity of 91% in
 19 relation to diagnosed depression¹⁴. General health was assessed using the Medical Outcomes Study
 20 Short Form 36 (SF-36), The SF-36 represents multiple measures of physical and emotional health¹⁶.
 21 It comprises eight subscales: physical functioning, role-physical, role-emotional, bodily pain, general
 22 health, social functioning, mental health and vitality. It is scored on a range of 1 to 5 and transformed
 23 in accordance to the guidelines provided by Ware et al¹⁶ to a range of 0-100 where 0 correlates with
 24 worst possible score/function and 100 correlates with best possible score/function. The SF-36 has
 25 excellent validity (internal consistency $\alpha \sim 0.8$)¹⁷. As a measure of comorbidity, the presence of each

1 medical condition was given 1 point from a list of nine system-related conditions (cardiovascular,
 2 respiratory, musculoskeletal, endocrine, urogenital, cancer, neurological, mental health, and eye
 3 diseases). Physical activity was measured using the Incidental and Planned Exercise Questionnaire
 4 (IPEQ) that was designed for use with older people¹⁸. IPEQ measures the number of self-reported
 5 hours of exercise including both planned and incidental activities and has good psychometric
 6 properties (test-retest reliability 0.77, and internal consistency 0.6)¹⁸. Total time spent is summed
 7 across all components and expressed as hours per week¹⁸. Assistance required for everyday tasks was
 8 assessed with questions relating to dependence on others (relatives, friends and community services)
 9 for basic tasks involved in daily living activities such as cooking, cleaning, and shopping. It was
 10 scored in a binary fashion with any assistance for any task being given a score of 1.

11 Statistical analyses were performed using SPSS (Version 16.0). Several variables were
 12 transformed due to non-normal distributions based on a method suggested by Tabachnik and Fidell
 13 ¹⁹. A square root transformation was used for general health, physical functioning, mental health and
 14 IPAQ; a logarithmic transformation was used for Role-physical, Role-emotional and social
 15 functioning subscales of the SF-36; FES-I; and an inverse transformation was used for the depression
 16 subscale of the GAD scale. Differences between people with AMD and controls were evaluated
 17 using independent t-tests. Associations among the quality of life measures were assessed with
 18 Pearson correlations, and a linear regression analysis was used to elucidate the impact of AMD
 19 (entered separately as the first block) and physical, health and lifestyle factors (entered together in
 20 the second block) on depressive symptoms, excluding all the subscales associated with psychological
 21 domains. Path analysis was performed using SPSS in conjunction with Analysis of Moment
 22 Structures (AMOS 18.0) Graphics. AMOS was used to examine whether the impact of AMD on
 23 depressive symptoms was direct or indirect over associated poor general health. Goodness-of-fit²⁰ of
 24 the model was investigated by chi-square, Goodness-of-Fit Index (GFI) and Comparative Fit Index
 25 (CFI). Chi-square (χ^2) is a statistical test of lack of fit resulting from over-identifying restrictions

placed on a model, and should not be significant. GFI should be high (>0.90) as it assesses the extent to which the model provides a better fit compared with no model at all [35]. CFI represents relative reduction in lack of fit as estimated by comparing the existing model with a null model that assumes latent variables in the model to be uncorrelated; high values ($CFI > 0.90$) reflect a good model fit. Finally, standardized regression coefficients (rc), which are analogous to correlation coefficients, and explained variances were calculated.

RESULTS

The mean ages of the AMD and control groups were comparable: 78.0 ± 7.7 years and 78.1 ± 5.8 years respectively ($t_{1,247}=0.68$, $p=0.95$). Both groups comprised similar proportions of men with 53 (36.6%) in the AMD group and 30 (29.1%) in the controls ($\chi^2= 1.49$, $df=1$, $p=0.22$). Of a possible nine common medical conditions, the AMD group had a mean of 1.7 ± 1.0 and the control group 1.7 ± 0.9 ($t_1, 247=0.54$, $p=0.59$). In the AMD group, 62 people (43.1%) lived alone compared with 54 (52.4%) of the controls ($\chi^2= 2.11$, $df=1$, $p=0.15$) (Table 1).

Table 2 shows the GAD depressive symptoms, SF36 and IPEQ scale scores for the AMD and control groups. People with AMD performed significantly worse than the controls for the GAD depression scale and the SF-36 general health, physical functioning, social functioning and mental health subscales. For those with AMD, 63 (44.4 %) met the criteria for a clinically significant symptomatology compared with 18 (17.5%) of the controls ($\chi^2= 19.5$, $df=1$, $p<0.001$). Depressive symptoms were rare in the control population (3.3%) unless individuals had significant comorbidities. In the presence of a comorbidity score of >1 , a control patient had a 30% chance of having depressive symptoms; a patient with AMD but no comorbidity, had a 36% chance of having depressive symptoms, and a patient with AMD and a comorbidity score >1 had a 62% chance of having depressive symptoms. The AMD group had higher physical activity levels but required more

assistance with activities of daily living. 56 (38.6%) of those with AMD required assistance with one or more activities of daily living compared with 5 (4.9%) of the controls ($\chi^2= 37.0$, $df=1$, $p<0.001$).

Table 3 shows the bivariate correlations among the depressive symptoms, physical activity and quality of life scales for the AMD group. Depressive symptoms were significantly associated with the mental health, physical functioning, social functioning, and vitality subscales of the SF-36. Linear regression analysis revealed that AMD could explain 7.2% of the variance in depressive symptoms when entered alone at an initial step. Three health and activity measures: poorer general health, higher levels of bodily pain, lower levels of social functioning and number of comorbidities, met the inclusion criteria at second step. Combined, these variables plus AMD explained 31% of the variance in AMD. The standardised beta weights were -0.27 for AMD, -0.17 for general health, -0.21 for social functioning, -0.17 for bodily pain and 0.13 for comorbidity. The path analysis further examined the relationship between AMD and depressive symptoms (Figure 1). The results showed that 27% of the variance in the depressive symptoms was explained by the variables in this model, and that AMD led to depressive symptoms both directly and indirectly by reduced general health and social functioning. Goodness-of-fit indicators revealed that the model had a good fit ($\chi^2(6)=22.45$, $p=0.001$, $GFI=0.97$, $CFI=0.93$).

DISCUSSION

The current study confirms the high prevalence of depressive symptoms in older people with AMD, with nearly half of the AMD group having clinically significant depressive symptoms. Brody et al⁸, using previous studies of community samples, suggested that AMD was responsible for doubling the prevalence of depressive symptoms. Our study however indicates a much greater effect, where the presence of AMD may increase the risk of depressive symptoms in a person without comorbidity by 10 fold.

The study findings also indicate that people with AMD differ from their age-matched peers in measures of general health, physical and social functioning and requirements for assistance to undertake daily living activities - measures that are all associated with diminished quality of life²¹. It has been previously reported that people with AMD have a reduced quality of life as assessed with the SF-12²². The current study builds on this by more extensively assessing aspects of mood and quality of life. We found that people with AMD had significantly reduced physical and social functioning subscale scores even though they reported that their physical and emotional health did not interfere with their functioning (Role - Physical and Social). The AMD group also reported reduced mental health and general health scores even though there were no significant differences in reported comorbidities between the AMD and control groups.

The linear regression analysis revealed that AMD was independently associated with depressive symptoms and that with the addition of three health and activity measures: poorer general health, higher levels of bodily pain, lower levels of social functioning and number of comorbidities, these measure could account for 31% of the variance in depressive symptoms. The path analysis provided a complementary analysis of “causal” pathways underlying depressive symptoms and showed that AMD led to depressive symptoms both directly and indirectly via reduced general health and social functioning.

We acknowledge that the study has certain limitations. Firstly, data on the occurrence of recent major life events were not recorded. Therefore assumptions about the impact of this factor on depressive symptoms cannot be inferred from this study. Secondly, people with severe AMD were excluded, however we assume that people with more severe AMD would present with further reduced function and increased emotional distress. Thirdly, since all the patients were from semi-urban and urban areas, the findings may not be generalizable to rural areas, where interactions between the level of social support and access to the health services may be different. Finally, we acknowledge that as we did not collect visual acuity data we are unable to determine whether AMD

1 directly causes depressive symptoms or causes depressive symptoms by reducing visual acuity.
2 None-the-less we feel that the strong association found between AMD and depressive symptoms is
3 clinically important and requires further research to elucidate underlying mechanisms and
4 intervention possibilities.

5 Consistent with previous studies²³⁻²⁶ our findings suggest that people with AMD have more
6 depressive symptoms and a reduced quality of life. The current study adds to this work by
7 delineating possible health and lifestyle mechanisms by which AMD may lead to these psychological
8 and health conditions. Screening people with AMD with respect to depressive symptoms and their
9 ability to perform everyday tasks, with subsequent referral for further evaluation and support
10 services, could assist in maintaining the quality of life in this group²⁷.

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Table 1: Demographics of the study sample: AMD and control

		AMD (n=145)	Controls (n=104)
		Mean (SD)	Mean (SD)
Age		78.01 (7.73)	78.07 (5.8)
Gender	Male	53	31
	Female	92	73
Comorbidity		1.53 (1.21)	1.54 (1.07)
Socioeconomic status			
Above average		111*	102*
Below Average		29*	1*
Living arrangements			
Alone		62	54
With Spouse		54	31
Spouse and children		8	7
Children		13	5
Relatives		2	3
Other		5	3

Chi-square test was performed for Gender, socioeconomic status and living arrangements and

ANOVA was done for age difference between the two groups; *p<0.01, statistically significant.

1 **Table 2: Depression, SF-36 and IPAQ scale scores: AMD and control comparisons**

Scale	AMD (n=145)	Controls (n=104)
	Mean (SD)	Mean (SD)
Depression	2.8 (2.1)*	1.7 (1.4)
General health	59.42 (20.6)	63.42 (21.5)
Physical functioning	52.27 (29.94)*	63.19 (24.42)
Role- Physical	53.68 (40.82)	56.79 (40.32)
Role – Emotional	71.27 (37.7)	74.66 (32.68)
Vitality	52.84 (19.99)	55.27 (23.10)
Bodily pain	60.76 (25.34)	62.37 (24.49)
Mental health	73.87 (17.73)	79.80 (18.0)
Social functioning	74.75 (25.66)	70.61 (21.72)
IPAQ†	29.87 (13.19)*	22.23 (10.54)

2 †Total hours of planned and incidental physical activity/week

3 * p<0.01; ANOVA.

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Table 3: AMD Group: Pearson's correlation co-efficients (R) for GAD depression, SF 36 and IPAQ scales

	2	3	4	5	6	7	8	9	10	11	12	13
1	0.20*	0.28**	-0.29**	-0.21*	-0.41**	-0.25**	-0.09	-0.32	-0.20	0.41	-0.35**	-0.33**
2	-	0.65**	-0.53**	-0.65**	-0.27**	-0.42**	-0.19**	-0.49**	-0.32**	0.37**	-0.35**	0.59**
3	-	-	-0.53**	-0.54**	-0.43**	-0.53**	-0.29**	-0.61**	-0.33**	0.38**	-0.38**	-0.55**
4	-	-	-	0.55**	-0.38**	0.45**	0.18*	0.55**	0.31**	-0.39**	0.48**	-0.51**
5	-	-	-	--	0.19*	0.35**	0.82	0.56**	0.24**	-0.24**	0.31**	0.50**
6	-	-	-	-	-	0.43**	0.35**	0.46**	0.35**	-0.48**	0.41**	0.24**
7	-	-	-	-	-	-	0.25**	0.57**	0.44**	-0.28**	0.41**	0.32**
8	-	-	-	-	-	-	-	0.31**	0.22**	-0.26**	0.18**	0.19**
9	-	-	-	-	-	-	-	-	0.42**	-0.33**	0.47**	0.50**
10	-	-	-	-	-	-	-	-	-	-0.16*	0.38**	0.24**
11	-	-	-	-	-	-	-	-	-	-	-0.25**	-0.26**
12	-	-	-	-	-	-	-	-	-	-	-	0.56**
13	-	-	-	-	-	-	-	-	-	-	-	-

1 = ADLA: Assistance with Daily Living Activities; 2 = Anxiety; 3 = Depression; 4 = Social functioning; 5 = Mental health; 6 = Physical functioning; 7 = General health; 8 = IPAQ; 9 = Vitality; 10 = Body pain; 11 = MFES; 12 = Role – physical; 13 = Role – emotional

* p<0.05, **p< 0.01

- 1 **Figure 1. Output of the path analysis. Values shown are standardized regression coefficients.**
- 2 **Direct effects are provided next to each arrow and explained variances are provided in bold**
- 3 **above each variable.**

